

WHAT IS CLAIMED IS:

1. An ink-jet head comprising:

a passage unit that has a plurality of pressure  
5 chambers and a plurality of nozzles communicating with the  
respective pressure chambers,

an actuator unit that is adhered to the passage unit  
and changes the volume of the pressure chambers to thereby  
eject ink through the nozzles, and

10 a cable member that supplies a drive signal to the  
actuator unit;

wherein the actuator unit includes:

a piezoelectric element sandwiched by a common  
electrode and a plurality of surface electrodes, the  
15 plurality of surface electrodes being formed on the  
piezoelectric element at positions corresponding to the  
respective pressure chambers,

a plurality of first lands formed on the  
piezoelectric element to be connected to the respective  
20 surface electrodes, the first lands having a higher height  
from a surface of the piezoelectric element than that of  
the surface electrodes and being connected to the cable  
member, and

a plurality of second lands formed on the  
25 piezoelectric element to be spaced from the respective

surface electrodes, the second lands having substantially the same height from the surface of the piezoelectric element as that of the first lands.

5    2.    The ink-jet head according to claim 1, wherein each of the surface electrodes is provided with a corresponding one of the first lands and a corresponding one of the second lands that make a pair and are positioned symmetrically with respect to a center of a corresponding  
10 one of the pressure chambers.

3.    The ink-jet head according to claim 2, wherein:  
the plurality of pressure chambers are formed adjacently to each other on a surface of the passage unit;  
15 and

each of the surface electrodes is surrounded with the corresponding first and second lands in a pair, and is also surrounded with one of a first land and a second land in a pair corresponding to at least one surface electrode  
20 adjacent to the surface electrode.

4.    The ink-jet head according to claim 3, wherein the surface electrode is surrounded with two or more first lands and two or more second lands that are positioned  
25 symmetrically with respect to the center of the

corresponding pressure chamber.

5. The ink-jet head according to claim 4, wherein:  
the pressure chambers have a quadrilateral shape; and  
5 the surface electrode is surrounded with three first  
lands and three second lands that are arranged in a  
hexagonal formation.

6. The ink-jet head according to claim 5, wherein:  
10 the pressure chambers have a rhombic shape; and  
the surface electrode is surrounded with the three  
first lands and the three second lands that are arranged in  
a regular-hexagonal formation.

15 7. The ink-jet head according to claim 1, wherein each  
of the surface electrodes is surrounded with two or more  
first lands and two or more second lands that are  
positioned symmetrically with respect to a center of a  
corresponding one of the pressure chambers.

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8. The ink-jet head according to claim 1, wherein both  
the first and second lands have substantially the same  
circular shape having substantially the same diameter.

25 9. The ink-jet head according to claim 1, wherein each

of the surface electrodes has a main electrode portion  
opposing a corresponding one of the pressure chambers and a  
connecting portion connected to a corresponding one of the  
first lands, the main electrode having a planar shape  
5 similar to that of the corresponding pressure chamber.

10. The ink-jet head according to claim 1, wherein the  
common electrode is kept at a constant potential and is  
formed to span the plurality of pressure chambers, the  
10 common electrode being disposed nearer to the pressure  
chambers than the surface electrode.

11. The ink-jet head according to claim 1, wherein the  
cable member is a flexible flat cable that has a wiring  
15 pattern and terminals formed thereon, the flexible flat  
cable being connected to the actuator unit, and the  
plurality of first lands being connected to the respective  
terminals of the flexible flat cable.

20 12. The ink-jet head according to claim 1, wherein the  
plurality of pressure chambers are arranged in a matrix on  
a surface of the passage unit.

13. The ink-jet head according to claim 1, wherein the  
25 passage unit has a plurality of wall portions that separate

the pressure chambers from each other, and the first lands and the second lands formed on the piezoelectric element are opposed to the wall portions.

5 14. The ink-jet head according to claim 1, wherein the second lands are connected to the cable member.

15. An ink-jet head comprising:

10 a passage unit that has a plurality of pressure chambers, a plurality of nozzles communicating with the respective pressure chambers, and a plurality of wall portions separating the pressure chambers from each other,

an actuator unit that is adhered to the passage unit and changes the volume of the pressure chambers to thereby  
15 eject ink through the nozzles, and

a flexible flat cable that has a wiring pattern and terminals formed thereon, and is connected to the actuator unit to supply a drive signal to the actuator unit;

wherein the actuator unit includes:

20 a piezoelectric element disposed on the passage unit so as to span the plurality of pressure chambers,

a plurality of surface electrodes formed on the piezoelectric element, each of which has a main electrode portion opposing a corresponding one of the pressure  
25 chambers and a connecting portion extending from a

corresponding one of the main electrode portions to oppose a corresponding one of the wall portions,

a common electrode kept at a constant potential and formed to span the plurality of pressure chambers, the  
5 common electrode being disposed nearer to the pressure chambers than the surface electrodes with the piezoelectric element sandwiched between the common electrode and the surface electrodes, and

a first land and a second land that make a pair for  
10 each of the surface electrodes and are positioned on the piezoelectric element symmetrically with respect to a center of a corresponding one of the pressure chambers, both the first land and the second land opposing the wall portions and having substantially the same height, from a  
15 surface of the piezoelectric element, higher than that of the surface electrodes; and

wherein the first land is connected to the connecting portion of a corresponding one of the surface electrodes and connected to a corresponding one of the terminals of  
20 the flexible flat cable, and the second land is spaced from the corresponding surface electrode.

16. A method for manufacturing an ink-jet head comprising the steps of:

25 forming a passage unit that has a plurality of

pressure chambers, a plurality of nozzles communicating with the respective pressure chambers, and a plurality of wall portions separating the pressure chambers from each other, and

5       forming an actuator unit that changes the volume of the pressure chambers to thereby eject ink through the nozzles;

the step of forming the actuator unit including the steps of:

10       disposing, at a piezoelectric element, a plurality of surface electrodes and a common electrode opposing the plurality of surface electrodes,

forming a plurality of first lands on the piezoelectric element to be connected to the respective  
15 surface electrodes, the first lands having a higher height from a surface of the piezoelectric element than that of the surface electrodes, and

forming a plurality of second lands on the piezoelectric element to be spaced from the respective  
20 surface electrodes, the second lands having substantially the same height from the surface of the piezoelectric element as that of the first lands; and

the method further comprising the steps of:

forming an adhesive layer on the wall portions of the  
25 passage unit, and

positioning the actuator unit onto the passage unit such that the surface electrodes oppose the respective pressure chambers and both the first and second lands oppose the wall portions, and then disposing a pressurizing  
5 member on the actuator unit to press and adhere the actuator unit to the passage unit.

17. A method for manufacturing an ink-jet head according to claim 16, further comprising the step of attaching a  
10 flexible flat cable on the actuator unit such that terminals of the flexible flat cable are connected to the respective first lands.